(No Model.) 2 Sheets—Sheet 1.

W. F. BROWNE.

DOUBLE ACTING PROPORTIONATING DUPLEX PLUNGER PUMP.

No. 532,637. Patented Jan. 15, 1895.

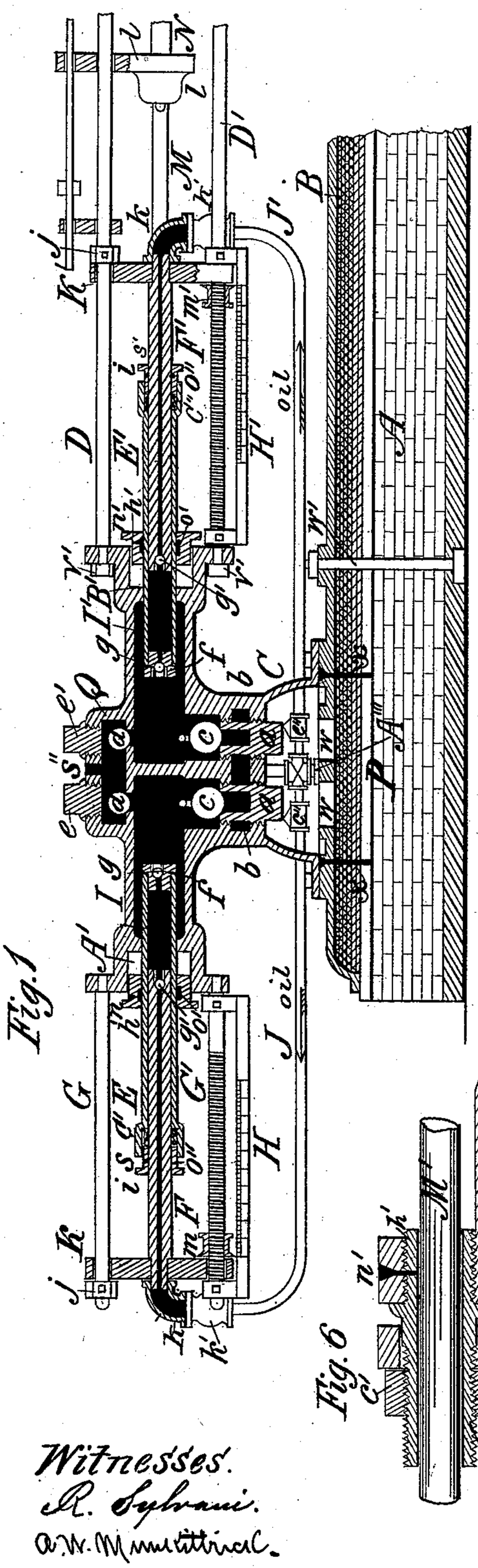

Fig. 1

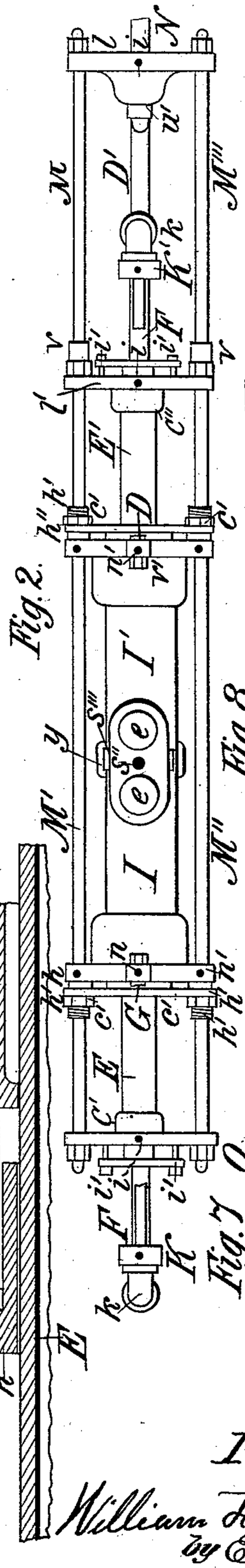

Fig. 2.

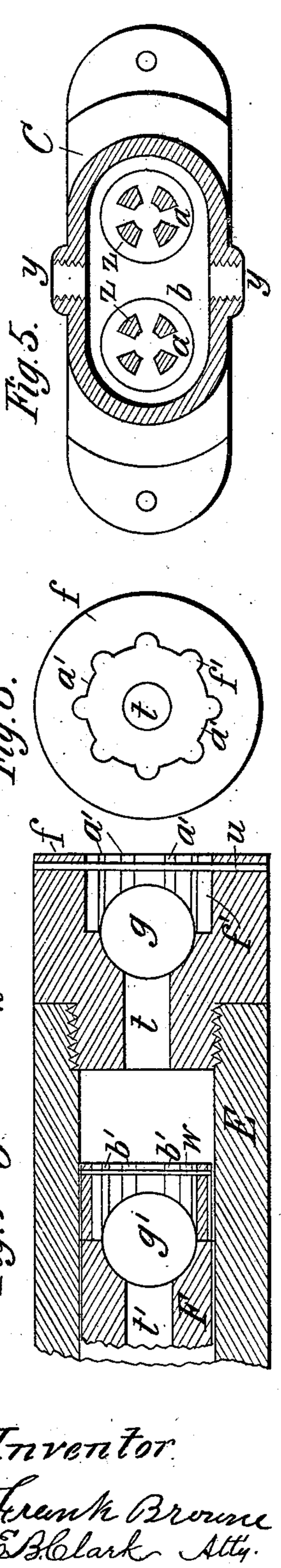

Fig. 5.

Fig. 8.

Fig. 6

Fig. 7

Witnesses.
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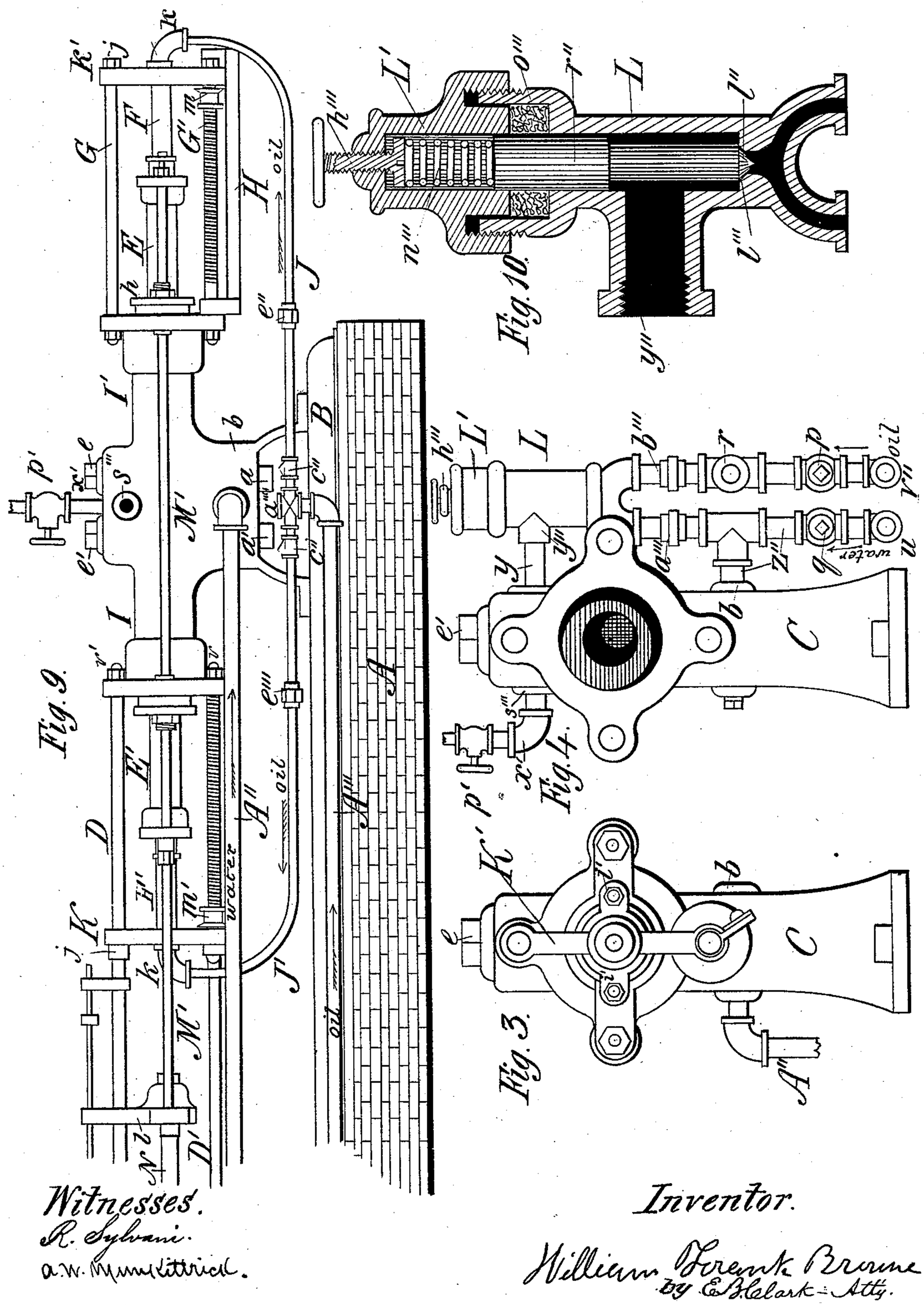

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R. Sylvani.
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UNITED STATES PATENT OFFICE.

WILLIAM FRANK BROWNE, OF NEW YORK, N. Y.

DOUBLE-ACTING PROPORTIONATING DUPLEX PLUNGER-PUMP.

SPECIFICATION forming part of Letters Patent No. 532,637, dated January 15, 1895.

Application filed April 27, 1891. Serial No. 390,714. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM FRANK BROWNE, a citizen of the United States, and a resident of the city, county, and State of New York, have invented a new and useful Double-Acting Proportionating Duplex Plunger-Pump; and I do hereby declare that the following is a full description thereof, reference being had to the accompanying illustrations, which form a part of this specification.

This invention relates to a pump for pumping and mixing or emulsifying two different kinds of liquids in any desired proportions.

The invention consists in providing a pump with differential plungers, one working within the other, the outer plunger working full stroke while the internal plunger works at either full stroke or any part thereof, thus causing a difference in the quantity of the two liquids delivered in proportion to the stroke of the inner plunger.

Figure 1 represents a vertical longitudinal central section of a differential, proportionating, double acting duplex plunger pump. Fig. 2 represents a top plan view of Fig. 1. Fig. 3 represents an end view, on enlarged scale, of Fig. 1. Fig. 4 represents an end view, on enlarged scale, of the body of the pump with the plungers removed, but with the circulating device attached to the induction and eduction ports. Fig. 5 represents a horizontal section of the pump cutting through the suction chamber beneath the induction valves. Fig. 6 represents a broken horizontal sectional view on an enlarged scale, of a plunger, gland, stuffing box, stud-bolt-bearing and connecting rod therein. Fig. 7 represents an enlarged view of the inner ends of the duplex plungers showing check valves. Fig. 8 represents an end view of one of the external plungers, showing the ball valve seat. Fig. 9 represents an external view of the pump showing the feed pipes for the two liquids to be emulsified, the circulating device being removed to better show other parts. Fig. 10 represents a vertical sectional view, on enlarged scale, of the circulating device.

The pump, Fig. 1, is secured to an iron base B, which in turn is secured to a wooden base P, by bolts, *x*, all resting upon masonry, A, and properly secured thereto by bolts, *w'*; this foundation being of the requisite length to support the steam cylinder which is connected to the pump by rods D and D', these rods being secured to the pump by nuts *v* and *v'*. The two cylinders I and I', of the pump, Fig. 1, are provided with stuffing boxes A', and B', into which are fitted the glands *h* and *h'*. These glands are provided with internal annular grooves, *o'*, each gland having the hole *n* and *n'* communicating therewith.

The external plungers E and E' are tubular and are provided with stuffing boxes C' and C'', into which are fitted glands *s* and *s'*, said glands being provided with internal annular grooves *o''*, with holes, *i*, connecting therewith. Within the grooves of these glands, a fibrous material should be placed for the purpose of absorbing and retaining the oil, and lubricating the plungers while in action. By this means of lubrication the plungers are kept oiled over their entire surface. Self oiling cups can be secured to the glands for the purpose of keeping the plungers well oiled during a long time in action. The stuffing boxes C', C'' and their glands, *s*, *s'*, and packing are fitted tightly to the plungers F and F', so that by the frictional contact the plungers F and F', will be carried by the plungers E, E', in their backward strokes till the posts K, K', strike the detents or stops, *j*, *j*, and in their forward strokes, till said posts K, K', strike against the adjustable nuts *m*, *m'*, on the screw-threaded rods G' and D'. The inner ends of these plungers, E, E' and F, F', are provided with ball valves, *g*, *g*, *g'* and *g'*. These balls are kept from leaving their cages by means of wires *u* and *w*, shown in Fig. 7.

The heads, *f*, of the external plungers, E, are made in one piece and secured to said plungers, as shown in Fig. 7. The balls *g* and *g'*, are seated in front of the orifices, *t* and *t'*, as shown in Fig. 7, thus forming tight joints, when the plungers E, E', are making forward strokes and the back pressure is against the balls; but, when the pressure is relieved and the motion of the plungers, E, E', is reversed, the balls roll forward upon the ribs, *a'* and *b'*, thus allowing the liquid to flow through channels *f'* into their respective cylinders I and I'.

The external ends of the two plungers F, F', are provided with elbows, *k*, or some other suitable connection, and to these elbows, flexible pipes, J, J', are attached while their

other ends are secured to a fitting, a'''', as shown in Fig. 9, or to a fitting, v'', shown in Fig. 4, which in practice is connected with an oil supply pipe A''', Fig. 9.

To the ends of plungers F and F', sliding posts K and K', are secured for the purpose of supporting, guiding and limiting the movement of the plungers F, F'. They are supported at each of their ends by guide rods, D, D', and G, G'. The two rods D' and G', are screw-threaded and provided with traveling nuts, m, m', and indicator scales H, H'. The nuts are for the purpose of limiting the forward movement of the plungers, the movement being previously determined by moving said nuts, m, m', to any of the divisions on the scales H, H', which indicate and determine the proportion of the liquids required to be pumped or emulsified.

The backward movements of the plungers are arrested by the fixed detents or stops, j, j, which are secured to the rods G, G', and D, D' at the extreme limit of the backward movement of the plungers. The two nuts, m, m', are shown to be turned up against the two posts K, K', thereby causing the plungers F, F', to remain in a fixed position, while the plungers E, E', will slide over them the entire length of their strokes. Therefore while the plungers F, F', are in this position, the volumes of their displacement being equal to one-half of those of the plungers, E, E', the two liquids will be pumped in equal quantities, or fifty per cent. of each. In order to change this proportion to any required amount, the nuts, m, m', must be moved forward to a corresponding division on the scales, H, H', thereby allowing the two plungers F, F', to move forward until stopped by the nuts while the external plungers E, E', complete their strokes. By means of this partial movement of the inner plungers and complete movement of the external plungers chambers are formed between the heads of the external plungers and the ends of the internal plungers, whereby said chambers are filled with liquid by the suction caused by the greater movements of the external plungers.

The pump is provided with two induction ball valves c and c, which are seated upon the top of two plugs, a, Figs. 1 and 5, these plugs having passages for the induction of liquid which is drawn in to the chamber b, through openings, y, shown in Fig 5. The plugs are made to screw up from the bottom of the pump, the thread of which is divided into two parts, the division appearing at, and forming a part of the suction chamber, b, the upper part of the plugs being supported by posts, z, while the spaces between the posts form passages for the liquid to be drawn up through the center of said plug into the cylinders, I, I', from whence it is discharged by the plungers E, E', on lifting valves d, and d into valve chamber Q, from whence it is discharged through an opening, s'', or through lateral openings, s''', s'''. The ball valves d, d, are kept in place by plugs e, e'. The valves can be removed or replaced by removing the plugs e, e'.

Cross-head l, is connected to the cross head, l', of plunger E' by means of connecting bars or rods M, M''' and nuts v, as shown in Fig. 2, while the two cross-heads of the two plungers E, E', are connected by the two connecting rods M', M''. The rods M', M'' slide through journal-stud-bolt-bearings h'; these bearings being secured to the projecting lugs which are cast to each end of the pump, as fully shown in Figs. 1, 2, 3, 4 and 6. The flanges or lugs of the glands h, h'', embrace the stud-bolts (Fig. 6) and are held in position by nuts c'. Therefore, it will be perceived that the stud-bolt-bearings perform a double function.

The circulating attachment, L, shown in Fig. 4, is provided with a valve, l'', which is raised when the back pressure is too great, thereby allowing the surplus liquid or emulsion to be returned again to the induction chamber, b, and be pumped over again until said back pressure is relieved, the emulsion being returned to the respective cylinders, I, I', and plungers F, F'; said return being through connections a''', into the suction chamber b at z'', and through connection b''' and fitting, r, into pipes J, J', into plungers F, F', the check valves q and p (Fig. 4) preventing the emulsion from returning to the oil and water reservoirs.

The circulation of the emulsion can be maintained any length of time required simply by closing a valve, p', on the discharge pipe, x', and if a perfect emulsion is required, similar to an emulsion of cod liver oil or other oils, a quick motion can be given to the plungers while at the same time the discharge can be reduced, whereby the emulsion can be made to circulate about in the pump and become thoroughly emulsified prior to its discharge; and furthermore this action can be performed under a very high pressure, of from one thousand to fifteen hundred pounds per square inch, thereby more thoroughly emulsifying the liquids than if under a low pressure,—the combined high pressure and violent action contributing to produce the desired result.

When the pump is required to pump but one liquid, the nuts, m, m', can be turned back or inward on rods G' and D', the entire length of the stroke of the plungers E, E', thus allowing the posts K, K', to be carried back and forth the full stroke of said plungers E, E', while the internal plungers will be thrust clear into the plungers E, E', and will remain with their inner ends against the heads, f, of said plungers. When the nuts and plungers are adjusted as above described the valves, k', k', on pipes J, J', are closed, thereby preventing liquid from entering the cylinder chambers, I, I', by way of the internal plungers F, F'. In the present indicated position of the internal plungers F, F', liquids in equal proportion will be discharged from the pump, but when the traveling nuts m, m', are moved ten points,

the liquids will be emulsified in the proportion of forty per cent. of oil to sixty per cent. of water, and at each of the ten points a ten per cent. change is made in each of the liquids, or one per cent. at each small division on the scales H, H′.

Whenever a third liquid is required in an emulsion, a third tubular plunger can be made to work in tubular plungers F, F′, or two liquids can be emulsified in the first instance and then pumped over again with the additional liquid, and also, the same may be done with any number of liquids.

When fixed proportions of liquids are required for an emulsion, the tubular plungers can be made to correspond to these proportions, whereby the internal plungers F, F′, will remain in a fixed position, as shown in Fig. 1, thus dispensing with the screw nuts, *m*, *m′*, and scales H, H′. The ball checks *g′*, *g′*, can be dispensed with, while the return of the liquid from the back pressure of the external plungers E, E′ will be held by check valves *c″*, *c″*, on induction pipe J, J′, Fig. 9, and also, when but a single liquid is to be pumped, the induction ball valves, *c*, *c* can be dispensed with thereby drawing all of the liquid through internal plungers F, F′.

During the inward or forward stroke of plungers, E, E′, liquid or emulsion is discharged from chambers I, I′, into and from valve chamber Q, and when posts K, K′, strike against nuts *m*, *m′*, then the internal plungers F, F′, are arrested while the external plungers complete their strokes, thereby causing liquid (oil) to be drawn from the internal plungers through their valve ports *t′*, *t′*, into the chambers of the external plungers, filling said chambers. Then during the backward or reverse strokes of the plungers, E, E′, liquid (water) is drawn from suction chamber, *b*, into chambers I, I′, and when the posts, K, K′, strike against the detents or stops, *j*, *j*, the plungers, F, F′, are arrested while the external plungers complete their backward strokes, thereby causing the liquid (oil) to be forced from the chambers of the external plungers through their ports, *t*, *t*, into the chambers, I, I′. In practice the water reservoir or supply is preferably placed at a suitable elevation above the induction, while the oil reservoir is placed at a suitable point below the induction, thereby causing the ball valves, *g*, *g*, and *g′*, *g′*, to be properly seated during the action of the pump, resulting in the proper proportions of oil and water being mixed and delivered as indicated by the positions of the traveling nuts, *m*, *m′*, in relation to the scales H, H′.

The exterior view of the pump, Fig. 9, shows the induction pipes, A″, A‴, for conducting liquids to the pump. When an emulsion of oil or petroleum and water is to be made the water is inducted through pipe A″, to the suction chamber *b*, shown in Figs. 1 and 5, while the oil or petroleum is inducted through pipe A‴, to the central fitting *a″″*, and thence through pipes J, J′, to the internal plungers F, F′. This action of the pump causes an emulsion of the two liquids to be made and then discharged through eduction pipe *x′* and valve *p′*. This emulsion, as discharged from the pump, is sufficient for immediate use, but when a permanent emulsion is required, it can be produced by forcing the emulsion from the pump under a high pressure and in a less quantity than is due to the capacity of the plunger, and for this purpose, I use a suitable circulating device L, shown in Figs. 4 and 10. This device is attached to the pump, as shown in Fig. 4, and with the two induction pipes A″, A‴, by means of fittings, *u* and *v″*. The water is inducted through pipe A″, and up through check valve, *q*, and enters the pump at *b*, while the petroleum is inducted through pipe A‴ and check valve *p* to the cross fitting *r*, where it divides and is inducted through pipes J, J′, to internal plungers F, F′.

The circulating device, as shown in vertical section Fig. 10, is provided with plunger *r″*, which has a conical end *l″*, closing an orifice at the seat *l‴*, connecting with the two connections, *a‴*, *b‴*, between the induction to the pump at *b*, and the fitting *r*, to which connect the pipes J, J′. The upper end of the plunger *r″*, is provided with a spring *n‴*, which can be compressed by the screw, *h‴*, thereby giving the desired pressure on the seat *l‴*. The plunger works through packing *o‴*, and is compressed to a tight joint by nut and gland L′. The lower portion of this plunger is made smaller than the upper portion for the purpose of producing a suitable surface for the liquid or emulsion to act upon when it returns from the pump. This device being connected to the induction and eduction ports of the pump, it will be seen that when valve, *p′*, on eduction pipe *x′*, is partly closed, a back pressure will be formed within the pump, the pressure being determined by the stroke of the pump and the opening of the eduction valve, and the pressure brought to bear upon plunger *r″* by spring *n‴*. Therefore when all the parts are properly adjusted, the back pressure of the emulsion in the pump will lift plunger *r″*, thus raising the valve, *l″*, from the seat, *l‴*, and allowing a portion of the emulsion to return to the respective induction ports of the pump and plungers. In the meantime, the check valves *q* and *p*, will close and prevent the emulsion from returning to the sources of supply from whence the component parts are drawn, but when a portion of the emulsion is discharged through the induction pipe *x′* and valve *p′*, the valves *q* and *p* will rise and admit enough of the two liquids to supply the demand.

The eduction or discharge of the emulsion can be so regulated by the valve *p′* and screw, *h‴*, that but a one-hundredth part of the liquid or emulsion due to the capacity of the plunger can be discharged, thereby causing the liquid or emulsion to circulate around ninety-nine times before it is discharged from

pump; or it can be made to circulate any the number of times desired, simply by a judicious use of valve p' and screw h'''.

Having now described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A pump for producing an emulsion of two or more liquids, in any desired proportion, said pump being provided with a main cylinder having an induction port, and also with two plungers, one plunger working within the other, an inlet to the cylinder or chamber in the outer plunger, and means for varying the stroke of the internal plunger, substantially as described.

2. A pump for pumping different kinds of liquid, in any desired proportions, to form an emulsion, said pump being constructed with a main cylinder having a mixing chamber and an induction port, in combination with an outer plunger working in said cylinder and containing a chamber having an independent liquid supply inlet or induction port and a second plunger working in said chamber, substantially as described.

3. A pump having a main cylinder with an induction port, and two tubular plungers, one working within the other, each plunger having a check valve, and the internal plunger having an induction pipe, and a passage to the cylinder or chamber in the outer plunger, substantially as described.

4. A pump having a main cylinder with an induction port, and two hollow plungers, one working within the other, in combination with a flexible induction pipe connecting with the internal movable plunger, substantially as described.

5. A pump for producing an emulsion from different kinds of liquids in any desired proportions, consisting of a main cylinder, provided with a suitable induction port and two tubular plungers, one working within the other, and the outer one working in the main cylinder, the internal plunger being provided with an inlet and passage to the interior of the outer plunger and also with suitable adjustable stops for determining the desired proportions of the different liquids to be emulsified, substantially as described.

6. A pump for pumping different kinds of liquids in any desired proportions, having a main cylinder with an induction port and two plungers, one working within the other, the internal plunger having an induction pipe, and a passage to the cylinder of the outer plunger, in combination with a supporting and guiding post, which travels with the internal plunger, a fixed stop and a movable indicating nut or detent, whereby said internal plunger is stopped at required points of its stroke, and the scale for determining the position of said detent and the proportions in which the liquids are pumped, substantially as described.

7. A pump for emulsifying two or more liquids, having a main cylinder with an inlet and two hollow plungers, one working within the other, the internal plunger having an induction pipe and a detent post secured to it, in combination with the guide rods, one of which is provided with a screw thread and a traveling detent nut thereon for the purpose described.

8. In combination with a double-cylinder pump having two plungers working in opposite ends of its cylinders, the rods which connect said plungers, the stud-bolt bearings for supporting and guiding said rods, the plunger glands connected and held to said stud-bolt bearings, substantially as described.

9. In combination with a double-cylinder pump, having a plunger working in each of the opposite ends of its cylinders, the rods connecting the heads of the two plungers, the stud-bolt bearings, h', secured to lateral lugs on the pump and passing through the lugs of of the glands at the ends of the pump, and jam-nuts on said stud-bolts, for forcing the glands against the packing in the stuffing boxes, substantially as described.

10. A pump for emulsifying two or more liquids, having a main cylinder with an induction port and two plungers, one working within the other, and an inlet to the chamber in the outer plunger, in combination with a circulating device, a pipe connecting said device with the eduction chamber of the pump and pipes connecting said device with the induction port of the main cylinder and with the inlet of said outer plunger, substantially as described.

11. A pump for emulsifying two or more liquids having a main cylinder with an induction port, an eduction chamber provided with a discharge pipe, having a controlling valve, and also having two plungers, one working within the other, and an inlet to the cylinder, of the outer plunger, in combination with a circulating device connecting with the eduction chamber of the pump, and pipes connecting said device with the inlets of the main cylinder and the outer plunger, substantially as described.

12. A pump for emulsifying two or more liquids having a main cylinder with an induction port, an eduction chamber provided with a discharge pipe having a controlling valve, and also having two plungers, one working within the other, the cylinder of the outer plunger having an inlet, in combination with a circulating device having a yielding plunger and valve, a pipe connecting said device above its valve with the eduction chamber of the pump and pipes connecting said device with the inlets of the main cylinder and the outer plunger, substantially as described.

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